QUANTIFICATION OF THE FUGITIVE EMISSIONS

at the

INTERMOUNTAIN GENERATING STATION (IGS)
(TWO UNIT SCENARIO)

Prepared for:

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CITY OF LOS ANGELES
P.O. NO. 45667

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Prepared by:

ENGINEERING-SCIENCE, INC.
125 West Huntington Drive
Arcadia, California 91006

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I. INTRODUCTION

Fugitive particulate matter emission factors from various operations such as western coal mining, the construction aggregate industries, iron and steel production, agricultural tilling, taconite mining, and roads have been the subject of substantial interest for some time. The development of such factors is difficult because of the problems and expense associated with testing required to develop basic data. Consequently, factors currently used range from single valued numbers to fairly complex empirical equations requiring selection of values for the parameters used in the equations. Furthermore, because factors are not explicitly available for many source categories, it has been necessary to apply available factors to other (hopefully related) sources in the case of environmental impact analyses and permit applications. It is important and interesting to note that there are no official emission factors (such as those in the EPA document AP-42) for coal handling at utility plants.

Many of the emission factors which have been used by those required to quantify emissions for coal-fired generating stations, marine coal terminals, etc., can be traced back to relatively few documents. Some of these factors, such as those from EPA/450/3-77/010, "Technical Guidance for Control of Industrial Process Fugitive Particulate Emissions," result in emission estimates that seem to be far too high. Many of these were based upon "engineering judgment" following observation of a source. More recently, the U.S. EPA has sponsored several studies which incorporated actual field measurement of source strengths. Techniques such as upwind-downwind sampling and plume profiling have been used. In December 1982 a draft final report titled "Fugitive Dust Emission Factor Update for AP-42" was submitted by the Midwest Research Institute to the U.S. EPA. Where possible we have drawn from this report. There are other useful reports, such the most recent compilation of BACT/LAER determinations and a control techniques guideline document for particulate matter, which are listed in the reference section of this report. Further, we have examined other documents covering or related to Prevention of Significant Deterioration application for coal-fired utilities. We also draw on our own experience in preparing analyses of particulate matter emissions from existing or proposed marine coal terminals.

II. APPROACH

We prepared the estimate of fugitive emissions from the Intermountain Generating Station in several steps. These are described briefly below.

- Definition of IGS Activities - Using information provided to us from the DWP, we prepared a detailed list of activities conducted at the IGS which might produce fugitive particulate matter emissions. The actual flow of coal and limestone was then developed.
- Selection of Emission Sources - From the IGS activity schedule produced in the above analysis and from the previous regulatory emissions analysis conducted by the U.S. EPA contractor (PEDCo), a revised list of specific emission sources was prepared. This list was used in all further analyses conducted.
- Review and Selection of Emission Factors - The regulatory analyses previously developed for this project and the various literature sources were reviewed and evaluated for use in the emissions quantification required in this study. Appropriate factors and applicable air pollution control efficiencies were selected. All issues and assumptions are identified and included in the appendices to this report. A table is also supplied giving particle distributions according to source of emissions.
- Activity and Scaling Factors - The activity levels and other scaling factors such as storage pile areas were prepared for a two-unit scenario. The rationale for selection of levels is covered in one of the appendices. Design data on fuel consumption rates, load factors, modes of coal delivery, vehicular traffic, control technology, etc., were supplied by the Department of Water and Power.

- Emission Calculations - Overall controlled emission factors were applied to activity levels and/or other scaling factors to prepare emission estimates for a maximum day case and on an annual basis.

III. RESULTS

Results of this study are presented in four tables. The first lists the emission factors and control efficiency for each source. The second lists emission estimates for a two-unit scenario. The third covers emissions from the Silo/Pug Mill Vent. These were provided by the Department of Water and Power, City of Los Angeles. The fourth table contains particle size distributions for the controlled emissions.

TABLE 1

INTERMOUNTAIN GENERATING STATION
EMISSION FACTORS AND CONTROL EFFICIENCIES - FUGITIVE DUST

	Uncontrolled Particulate Matter Emission Factors	Particulate Matter Controls Type	Particulate Matter Controls Efficiency (%)
COAL HANDLING			
Rail Car Dumper	0.04 lb/T	Enclosed, vent to F.F.	99.8
Truck Dumper	0.014 lb/T	Underground receiving	70.0
Conveying/Transfer			
Conveying	0.05 lb/T	Enclose, three sides	90.0
Truck Dumper to Conveyor (1 transfer)	0.00024 lb/T	Vent to F.F.	99.8
Transfer Buildings		Enclosed, vent to F.F.	99.8
Rail to Storage (3 transfers)	3 @ 0.00024 lb/T	" , " " "	99.8
Truck Conveyor 30 to storage (2 transfers)	2 @ 0.00024 lb/T	" , " " "	99.8
Storage to Boilers (6 transfers)	6 @ 0.00024 lb/T	" , " " "	99.8
Conveyor No. 6 to stacker	1 @ 0.00024 lb/T	None	0
Coal Stack-out	0.00011 lb/T	Telescopic spout & wet suppression	85.0
Coal Reclaim (Active Pile)	0.00024 lb/T	Underground plow	85.0
Coal Crusher	0.15 lb/T	Enclosed, vent to F.F.	99.8
Coal Storage			
Active Pile	0.00046 f lb/T*	Residual moisture	50.0
Reserve Pile	0.47 f lb/acre-day*	Compacting & crusting agent	90.0
LIMESTONE HANDLING			
Truck Dumper	0.014 lb/T	Underground receiving	70.0
Conveying/Transfer			
Conveying	0.05 lb/T	Enclosed, three sides	90.0
Truck Dumper to Conveyor No. 1 (1 transfer)	0.00024 lb/T	Vent to F.F.	99.8
Limestone Stack-out	0.00011 lb/T	Telescopic spout	75.0
Limestone Reclaim (Active Pile)	0.00024 lb/T	Underground plow	85.0
Transfer to Preparation Building (1 transfer)	0.00024 lb/T	Enclosed, vent to F.F.	99.8
Limestone Crusher	0.15 lb/T (crushing only)	Enclosed, vent to F.F.	99.8
Limestone Storage			
Active Pile	0.00046 f lb/T*	Residual moisture	50.0
Reserve Pile	0.47 f lb/acre-day*	Compacting & crusting agent	90.0
FLY ASH SILO UNLOADING	.00020 lb/T wet ash	Wet mixing with scrubber sludge	Same as Controlled
ROADS			
Haul Road - Coal	0.55 lb/VMT	Paved	Considered
Haul Road - Limestone	0.55 lb/VMT	Paved	Considered
Access Road - Solid Waste Area	1.96 lb/VMT	$CaCl_2$ treatment	50.0
Haul Road - Solid Waste (from Stacker Disposal Area)	1.57 lb/VMT	Watering	50.0
BURIAL OF SOLID WASTE (Dirt Movement)	0.116 lb/T earth	None	0
SOLID WASTE/SOIL STOCKPILE	0.47 f lb/acre-day*	Watering	50.0
SOLID WASTE BURIAL PILE	2.08 lb/acre-day	Compaction and reseeding	50 to 100 over 2.5 yr period

* Emission factors are expressed in terms of "f" (percentage of time wind speed exceeds 12 mph at mean pile height)

TABL. 2

TWO UNIT EMISSIONS ESTIMATE - INTERMOUNTAIN GENERATING STATION

	Annualized Avg. Day Basis	Maximum Day Basis	Controlled Emission Factor* (Max. Day)	Annualized Avg. Day Emission Rate** (g/sec)	Maximum Day Emission Rate** (g/sec)
COAL HANDLING					
Railroad Car Dumper	1.46×10^4 ton/day	2.47×10^4 ton/day	8.0×10^{-5} lb/ton	6.13×10^{-3}	1.04×10^{-2}
Truck Dumper	1.62×10^3 ton/day	1.91×10^3 ton/day	4.2×10^{-3} lb/ton	3.57×10^{-2}	4.21×10^{-2}
Conveying/Transfer					
Conveying	1.62×10^4 ton/day	1.91×10^4 ton/day	5.0×10^{-3} lb/ton	0.425	0.501
Truck Dumper to Conveyor	1.62×10^3 ton/day	1.91×10^3 ton/day	4.8×10^{-7} lb/ton	4.08×10^{-6}	4.81×10^{-6}
Transfer Buildings					
Rail to Storage	1.46×10^4 ton/day	2.47×10^4 ton/day	1.44×10^{-6} lb/ton	1.10×10^{-4}	1.87×10^{-4}
Truck to Storage	1.62×10^3 ton/day	1.91×10^3 ton/day	9.6×10^{-7} lb/ton	8.16×10^{-6}	9.63×10^{-6}
Storage to Boilers	1.62×10^4 ton/day	1.91×10^4 ton/day	2.88×10^{-6} lb/ton	2.44×10^{-4}	2.89×10^{-4}
Conveyor #6 to Stacker	1.62×10^4 ton/day	2.66×10^4 ton/day	2.40×10^{-4} lb/ton	2.04×10^{-2}	3.35×10^{-2}
Coal Stack-out	1.62×10^4 ton/day	2.66×10^4 ton/day	1.65×10^{-5} lb/ton	1.40×10^{-3}	2.30×10^{-3}
Coal Reclaim	1.62×10^4 ton/day	1.91×10^4 ton/day	3.6×10^{-5} lb/ton	3.06×10^{-3}	3.61×10^{-3}
Coal Crusher	1.62×10^4 ton/day	1.91×10^4 ton/day	3.0×10^{-4} lb/ton	2.55×10^{-2}	3.01×10^{-2}
Coal Storage					
Active	1.62×10^4 ton/day	1.91×10^4 ton/day	2.3×10^{-4}f lb/ton	1.96×10^{-2} f	2.86×10^{-2} f
Reserve	24.2 acre	24.2 acre	4.7×10^{-2}f lb/acre-day	5.97×10^{-3} f	7.39×10^{-3} f
LIMESTONE HANDLING					
Truck Dumper	4.33×10^2 ton/day	5.10×10^2 ton/day	4.2×10^{-3} lb/ton	9.55×10^{-3}	1.12×10^{-2}
Conveying/Transfer					
Conveying	4.33×10^2 ton/day	5.10×10^2 ton/day	5.0×10^{-3} lb/ton	1.14×10^{-2}	1.34×10^{-2}
Truck Dumper to Conveyor	4.33×10^2 ton/day	5.10×10^2 ton/day	4.8×10^{-7} lb/ton	1.09×10^{-6}	1.29×10^{-6}
Limestone Stack-out	4.33×10^2 ton/day	5.10×10^2 ton/day	2.75×10^{-5} lb/ton	6.25×10^{-5}	7.36×10^{-5}
Limestone Reclaim	4.33×10^2 ton/day	5.10×10^2 ton/day	3.6×10^{-5} lb/ton	8.18×10^{-5}	9.64×10^{-5}
Transfer to Prep. Bldg.	4.33×10^2 ton/day	5.10×10^2 ton/day	4.8×10^{-7} lb/ton	1.09×10^{-6}	1.29×10^{-6}
Limestone Crusher	4.33×10^2 ton/day	5.10×10^2 ton/day	3.0×10^{-4} lb/ton	6.82×10^{-4}	8.03×10^{-4}
Limestone Storage					
Active	4.33×10^2 ton/day	5.10×10^2 ton/day	2.3×10^{-4}f lb/ton	5.23×10^{-4} f	7.62×10^{-4} f
Reserve	1.33 acre	1.33 acre	4.7×10^{-2}f lb/acre-day	3.28×10^{-4} f	4.06×10^{-4} f
FLY ASH SILO UNLOADING	2.01×10^3 ton/day	2.37×10^3 ton/day	2.0×10^{-3} lb/ton	2.10×10^{-3}	2.49×10^{-3}
ROADS					
Haul Road - Coal	122 mi/day	143 mi/day	0.55 lb/VMT	0.352	0.413
Haul Road - Limestone	54 mi/day	64 mi/day	0.55 lb/VMT	0.156	0.185
Access Road - Solid Waste	20 mi/day	24 mi/day	0.98 lb/VMT	1.03×10^{-1}	1.52×10^{-1}
Haul Road - Solid Waste	132 mi/day	218 mi/day	0.78 lb/VMT	5.41×10^{-1}	1.11
BURIAL - SOLID WASTE	1.18×10^2 ton/day	1.66×10^2 ton/day	0.116 lb/ton	7.19×10^{-2}	1.01×10^{-1}
SOLID WASTE/SOIL STOCKPILE	2.6 acres	2.6 acres	0.24 f lb/acre-day	3.28×10^{-3} f	4.06×10^{-3} f
SOLID WASTE BURIAL PILE	20.7 acres	20.7 acres	0.52 lb/acre-day	5.65×10^{-2}	7.00×10^{-2}

* For factors including a term for the number of dry days (d) per year, the controlled emission factor is modified for the maximum day emission rate by letting d = 365. This essentially eliminates the credit for wet days.

** Emission results are calculated by multiplying the Basis (activity level or size in case of storage piles) by the Emission Factor. The results are produced in terms of lb/day for all activities. These are multiplied by conversion factors to produce the reported values expressed in grams per second. The conversion factor is: $\frac{5.25 \times 10^{-3}\ \text{g/sec}}{\text{lb/day}}$.

TABLE 3

INTERMOUNTAIN GENERATING STATION
ASH SILO/PUG MILL VENT EMISSIONS

Vent Parameter	Annual Average Emission Rate (g/sec)	Maximum Emission Rate (g/sec)
Baghouse Controlled Ash Silo Vent	0.125	0.147
Baghouse Controlled Pug Mill Vent	0.058	0.087

TABLE 4

PARTICLE SIZE DISTRIBUTIONS FOR
VARIOUS EMISSION CATEGORIES*

Source Type	Weight Percent Distribution by Aerodynamic Diameter (micrometers)				
	<30	<15	<10	<5	<2.5
Batch Drop (rail and truck dump)	100	66	49	32	18
Continuous Drop (conveyor transfer)	100	64	48	27	14
Pile Formation (coal)	100	62	47	25	14
Paved Roads	100	72	56	36	19
Unpaved Roads	100	71	56	35	20
Pile Erosion	None given - use Pile Formation Distribution				

* Distributions taken from Reference No. 1. All emission factors used are for particulate matter less than 30 micrometers in diameter. Therefore, distributions were normalized where necessary to a value of 100% for the <30 micrometer class.

APPENDICES

ISSUES AND ASSUMPTIONS

1. Rail Car Dumper - What is the worst case? On days with full rated load, 19100 tons/day coal is used and active coal pile contains three days' supply. Therefore, about 0.9 x 19,100 tons/day = 17,190 tons/day must be brought in on rail per day in order to avoid depleting active coal pile. Trains consist of 84 cars containing 98 tons coal/car, or 98 x 84 = 8,232 tons/train. Therefore, 17,190/8,232 = 2.09 trains/day. On an annual basis, assuming 85% load factor, average daily number of trains required = 2.09 x 0.85 = 1.77 trains/day. Since trains take only about 1.25 hours to unload, it seems reasonable to assume that on occasion there will be three trains in one day.

2. Limestone Reclaim - In this analysis we assume underground reclaim as with coal.

3. Limestone Truck Dumper - We assume no wet suppression.

4. Fly Ash Silo Unloading - Design information provided by the DWP shows that the fly ash is mixed with wet sludge in a pug mill prior to transfer to the disposal system. The resulting mixture contains 76% fly ash by weight and has a moisture content of 25%.

5. Unpaved Roads - We have assumed that $CaCl_2$ is being used on the solid waste access road and that the solid waste haul road will be watered.

6. Solid Waste/Soil Stockpile - We assume water spraying as needed.

7. Storage Pile Areas - We have used areas as supplied with Department of Water and Power design data.

8. Waste Disposal Pile - The wet fly ash/sludge mixture is covered with two feet of dirt which is compacted to 90% and re-seeded. We assume this treatment results in the covered pile returning to its natural state in 2.5 years.

9. Number of Dry Days Per Year - Climatological data for the City of Deseret was used. This data shows days of more than 0.01 inches of precipitation per year (a 45 year record) is equal to 42. However, approximately 18 of these are days of snow. Since snow effect persists for a longer period of time than rain we set a snow day as equal to 3 rain days. Therefore, we calculate the effective number of wet days (or days including snow cover) as being equal to 70. In examining the map of wet days in the U.S. EPA Publication AP-42, this number seems to be consistent with the number which would be selected by interpolation using the isopleths shown on the map.

MAXIMUM DAY ASSUMPTIONS - TWO UNITS

1. Rail Car Unloading (Coal) - Average number of trains is 1.77 at 85% capacity. Therefore, for worst day assume 3 trains of 84 cars each car containing 98 tons of coal. Total coal delivered by train on maximum day = 3 x 84 x 98 = 24,696 tons/day.

2. Truck Unloading (Coal) - Assume 10% of total coal burned delivered by truck. Since truck deliveries take about 16 hrs/day, assume that coal in the amount of 10% of rated daily Btu input is delivered. From DWP data, this is 1.91×10^3 tons/day.

3. Conveying - Assume maximum rate of coal use per day is conveyed or 1.91×10^4 tons/day.

4. Transfer of Coal -

   a. Rail to storage - 24,696 tons/day
   b. Truck to storage - 1,910 tons/day
   c. Storage to boilers - 19,100 tons/day
   d. Conveyor No. 6 to stacker - 24,696 + 1,910 = 26,606 tons/day

5. Coal Stack-out = 26,606 tons/day.

6. Coal Reclaim = 19,100 tons/day.

7. Coal Crushing = 19,100 tons/day.

8. Coal Storage - Worst day is based upon percent of time wind speed exceeds 12 mph at mean pile heights. A figure must be selected for this. Active Pile Area = 3.24 acres, Reserve Pile Area = 24.2 acres.

9. Limestone Hauling - All limestone is delivered by truck. Since truck deliveries take place 16 hrs/day, assume all limestone handling operations are rated at use equivalent to full load (rated) boiler operation. According to DWP design data, this is 510 tons/day.

10. Fly Ash Silo Unloading - This will take place at rate equivalent to that produced at full load operation. According to DWP design data, this is 2,368 tons/day. This is based upon 15.5% ash content of coal and fly ash being 80% of total.

11. Limestone Storage - Worst day is based upon wind speed as pile areas are assumed to be constant. Short Term (Active) Area = 0.14 acre, Reserve Storage Area = 1.33 acres.

12. Haul Roads -

a. Coal Trucks - Based upon maximum delivery rate by truck which is 1.91×10^3 tons/day, trip distance of 3 miles and truck capacity of 40 tons.

$$\text{Distance traveled} = \frac{1.91 \times 10^3}{40} \times 3 = 143 \text{ miles/day}$$

b. Limestone Trucks - Based upon maximum daily delivery rate which is 510 tons/day, trip distance of 3 miles, and truck capacity of 40 tons.

$$\text{Distance traveled} = \frac{510 \times 3}{24} = 64 \text{ miles/day}$$

c. Access Road - Solid Waste - Assume (DWP design data) 12 round trips/day at 2 miles/round trip, or 2 x 12 = 24 miles/day.

d. Trucking of Solid Waste from Stacker-Waste Disposal Area - Solid waste quantities given in DWP design data are 130 tons waste/hr or 3,120 tons/day, and 21,840 tons/week. However, sludge is hauled only 5 days/week, so delivery rate is 4,368 tons/delivery day. Truck capacity is 30 tons and trip distance is 1.5 miles.

$$\text{Distance traveled} = \frac{4{,}368 \text{ tons}}{\text{day}} \times \frac{\text{trip}}{30 \text{ tons}} \times \frac{1.5 \text{ miles}}{\text{trip}} =$$

$$218 \text{ miles/day}$$

13. Burial of Solid Waste - 4.32×10^4 tons dirt per year moved. A 5-day work week is assumed.

$$\text{Dirt moved/day} = \frac{4.32 \times 10^4 \text{ tons/yr}}{260 \text{ days/yr}} = 166 \text{ tons dirt/day}$$

14. Solid Waste Soil Stockpile - Maximum daily emissions depend upon per cent of time wind speed exceeds 12 mph at mean pile height.
Pile area = 2.6 acres (DWP design data)

Note: This stock pile is depleted in 2.5 years and is not replaced. The dirt is used to cover the solid waste. Therefore the worst day is at Day One of operations. It cannot coincide with the worst day for the covered solid waste.

15. Waste Disposal Pile - The waste disposal pile continues to grow. However, after 2.5 years the net excess emissions fall to zero. Therefore, a pile size equivalent to 2.5 years of waste is used as the basis of calculations. According to DWP furnished design data, an area of 500 ft x 3600 ft from which two feet has been removed will contain the solid waste generated over a period of five years when maximum pile height is 40 feet. Therefore, area of pile after two years equals $\frac{500 \text{ ft} \times 3600 \text{ ft}}{2} \times \frac{\text{acre}}{43{,}560 \text{ ft}^2} = 20.7$ acres.

NOTES ON EMISSION FACTORS

1. Rail Car Dump - The Stearns-Roger factor was used as there is very little information on this operation. The "batch drop" equation from Section 11.1 Fugitive Dust Sources (Ref. 1) could have been used.

2. Truck Dump - There is a specific factor given in Section 8.4, Western Surface Coal Mining and Processing, for bottom truck dumping. The factor used is the midrange of several listed.

3. Conveying Coal - The PEDCo factor was used. Conveying as an independent operation is poorly treated in the references examined.

4. Transfer Points - Coal - A change from the PEDCo report is recommended because current practice seems to be to calculate these emissions by transfer point. The factor recommended is that for Continuous Drop in Section 11.2, Fugitive Dust Sources (Ref. 1). It is calculated as follows:

$$\text{Emission Factor} = K\ (0.0018)\ \frac{\left(\frac{s}{5}\right)\left(\frac{U}{5}\right)\left(\frac{H}{10}\right)}{\left(\frac{M}{2}\right)^2}$$

where K = factor for <30 m particle range = .77
s = silt content = 5% (suggested for coal)
U = wind speed (avg.), assume 10 mph
H = drop height, assume 5 ft.
M = moisture content, assume 4.8% (suggested for coal)

E.F. = 0.00024 lb/ton coal

5. Active Pile Formation - Coal - This activity was not directly covered in the PEDCo report. The factor suggested comes from Table 7.5-1 in Reference No. 1. An efficiency of 85% is used for the telescopic spout and wet suppression.

6. Reserve Coal Storage - The formula for wind erosion from storage piles in Reference No. 1 is used. The formula is given below:

$$E = 1.7\left(\frac{s}{1.5}\right)\left(\frac{d}{235}\right)\left(\frac{f}{15}\right), \quad \text{(lb/day/acre)}$$

where s = silt content of aggregate = 5
d = number of days with <0.01 inches of precipitation per year = 295
f = percentage of time that unobstructed wind speed exceeds 12 mph at the mean pile height

$$E = 0.47 f$$

7. Active Coal Pile - The emission factor from Reference No. 7 for active coal piles is used. The formula is given below:

$$E = 0.05\left(\frac{s}{1.5}\right)\left(\frac{d}{235}\right)\left(\frac{f}{15}\right)\left(\frac{D}{90}\right), \quad \text{(lb/ton)}$$

where s = silt content = 5%
d = number of days with <0.01 inches of precipitation per year = 295
f = percentage of time that unobstructed wind speed exceeds 12 mph at mean pile height
D = duration of material storage = 3 days

$$E = .00046 f$$

8. Coal Pile Reclaim - Not previously included. The factor suggested is the same as for continuous drop transfer as a plow is used. An 85% control efficiency is claimed for underground transfer.

9. Coal Crushing - The Stearns-Roger factor was used as there was no other justifiable factor available.

10. Truck Dumper - Limestone - The same factor used for coal truck dumping was used. A control efficiency of 70% was claimed because the receiving hopper is underground.

11. Conveying - Limestone - The factor used is the same as for coal.

12. Transfer Points - Limestone - The PEDCo report covered all lime transfer and storage in one lumped factor. This was changed. The same factor as used for coal is suggested.

13. Active Pile Formation - Limestone - See (12) above. The same factor as used for coal is suggested.

14. Pile Reclaim - Limestone - See (12) above. The same factor as used for coal is suggested.

15. Limestone Crushing - This was not covered in the PEDCo report. The same factor as used for coal was selected as there is little other data available.

16. Fly Ash Silo Unloading - The continuous load-out equation given in item 4 is used, as the operation involves the drop of material from the pug mill which mixes solid waste with fly ash. The resulting mixture contains 76% fly ash by weight and has a moisture content of 25%. We will assume all fly ash is classified as silt and that the wind speed is 5 mph even though the transfer takes place inside a building. The drop height from the pug mill to the conveyor belt is approximately 15 feet. Therefore, the values of the equation parameters are as follows:

K = factor for <30 micron particle range = 0.77
s = silt content = 76%
U = wind speed, 5 mph
H = drop height, 15 feet
M = moisture content, 25%

$$E.F. = 0.77\ (0.0018)\ \frac{\left(\frac{76}{5}\right)\left(\frac{5}{5}\right)\left(\frac{15}{10}\right)}{\left(\frac{25}{2}\right)^2} = .00020 \text{ lb/ton mixture}$$

17. Trucking Solid Waste from Stacker Disposal Area - An emission factor obtained from the Utah Department of Health was used. The equation is:

$$E = 0.6 \times .81s \times \left(\frac{S}{30}\right)^2 \left(\frac{d}{365}\right)\left(\frac{N}{4}\right), \quad \text{(lb/VMT)}$$

where s = silt content, assume 5% for access roads and 6% for haul roads
S = vehicle speed, assume 30 mph for access roads and 20 mph for haul roads
d = number of days with <0.01 inches of precipitation per yar = 295
N = number of wheels on vehicles, assume 4 for access road vehicles and 6 for haul road vehicles

$$E \text{ (access roads)} = .6 \times .81 \times 5 \times \left(\frac{30}{30}\right)^2 \left(\frac{295}{365}\right)\left(\frac{4}{4}\right) = 1.96 \text{ lb/VMT}$$

$$E \text{ (haul roads)} = .6 \times .81 \times 6 \times \left(\frac{20}{30}\right)^2 \left(\frac{295}{365}\right)\left(\frac{6}{4}\right) = 1.57 \text{ lb/VMT}$$

18. Burial of Solid Waste - This factor is a reasonable mid-range estimate of factors given for soil and overburden removal in References (2), (16), and (D).

19. Haul Road - Coal Trucks - The suggested factor is based upon the recommended equation for industrial paved roads in Reference No. 1. This equation follows:

$$E.F. = K(0.090)\ I \left(\frac{4}{n}\right)\left(\frac{s}{10}\right)\left(\frac{L}{1000}\right)\left(\frac{W}{3}\right)^{0.7} \quad \text{(lb/VMT)}$$

where K = 0.86 for <30 m particle size range
I = industrial augmentation factor, assume I = 1
n = number of lanes, assume n = 4
s = surface silt material, %; assume S = 10
L = surface dust loading; assume L = 1000 lb/mile
W = vehicle wt.; assume W = 50 tons

then

$$E.F. = 0.86\ (0.09)\ (1) \left(\frac{4}{4}\right)\left(\frac{10}{10}\right)\left(\frac{1000}{1000}\right)\left(\frac{50}{3}\right)^{0.7} = \underline{0.55 \text{ lb/VMT}}$$

20. Haul Road - Limestone Trucks - Assume same factor as in (19) above.

21. Access Road to Solid Waste Area - See calculation in (17) above.

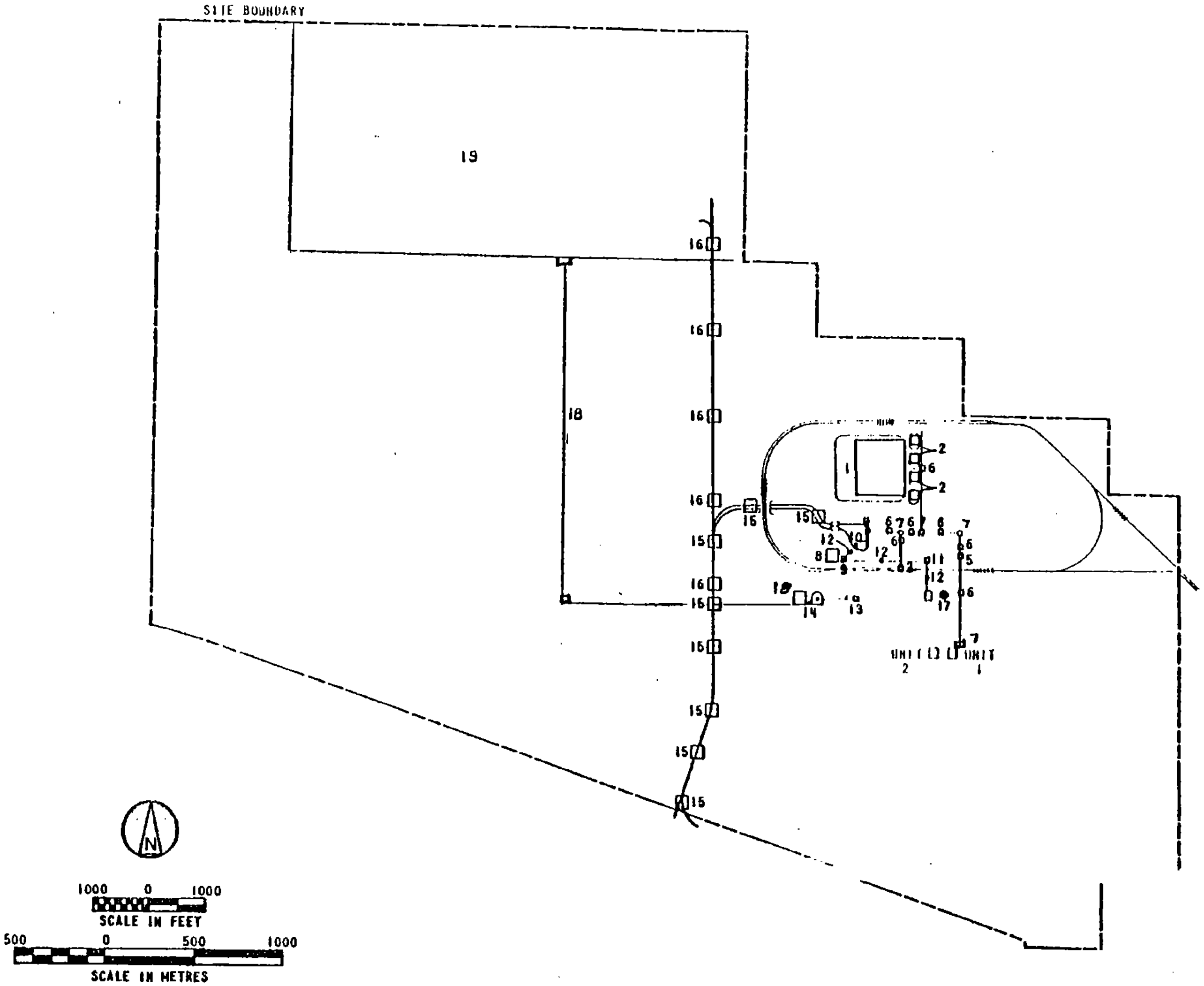
22. Reserve Limestone Storage - Use same factor as for coal.

23. Active Limestone Storage - Use same factor as for coal.

24. Waste Disposal Pile - Use the factor from Reference No. 1 for Erosion of Exposed Areas (section on Western Surface Coal Mining) = 0.38 ton/acre/yr. This factor will decrease to zero for areas which have been in place for longer than 2.5 years. The soil covering this pile will be compacted to 90% and re-seeded. The 2.5 year period allows for return to original terrain conditions. An intitial control efficiency of 50% is assumed for compaction and watering as needed. Thus, an average controlled factor of 0.095 ton/acre/year will be used as that applicable to a pile containing 2.5 years of solid waste disposal.

25. Solid Waste/Soil Stockpile - Use the same as for the reserve coal pile.

NOTE: For maximum day cases, those factors involving number of dry days such as those for storage piles and roads are altered as follows: Where the term $\frac{d}{235}$ appears, d is set at 365 instead of 295. Where the factor $\frac{d}{365}$ appears, d is also set at 365 instead of 295.



LEGEND

1 RESERVE COAL STORAGE
2 ACTIVE COAL STORAGE, CONVEYOR #6 TO STACKER, COAL STACK-OUT, COAL RECLAIM
3 COAL UNLOADING (RAILCAR)
4 COAL UNLOADING (TRUCK), TRUCK DUMPER TO CONVEYOR
5 COAL CRUSHING
6 COAL CONVEYING
7 COAL TRANSFER BUILDINGS
8 RESERVE LIMESTONE STORAGE
9 ACTIVE LIMESTONE STORAGE, LIMESTONE STACK-OUT, LIMESTONE RECLAIM
10 LIMESTONE UNLOADING (TRUCK) TRUCK DUMPER TO CONVEYOR
11 LIMESTONE CRUSHING, LIMESTONE TRANSFER TO PREP. BUILDING
12 LIMESTONE CONVEYING
13 FLY ASH SILO VENT, FLY ASH SILO UNLOADING
14 FLY ASH UNLOADING
15 COAL/LIMESTONE HAUL ROAD
16 SOLID WASTE ACCESS ROAD
17 CHIMNEY (UNITS 1 AND 2)
18 WASTE DISPOSAL CONVEYOR
19 WASTE DISPOSAL AREA - SOLID WASTE/SOIL STOCKPILE, BURIAL SOLID WASTE, HAUL ROAD SOLID WASTE

LOCATIONS OF FUGITIVE DUST SOURCES
(TWO UNITS)

REFERENCES

1. "Fugitive Dust Emission Factor Update for AP-42," DRAFT document, MRI report to U.S. EPA, EPA Contract No. 68-02-3177, No. 7, for IERL, U.S. EPA, RTP, NC 27711, Dec. 8, 1982.

2. "Survey of Fugitive Dust from Coal Mines," EPA-908/1-78-003, U.S. EPA, Region VIII, Denver, Colorado 80295, February 1978.

3. "Control Techniques for Particulate Emissions from Stationary Sources," Volume 1, EPA-450/3-81-005a, September 1982, and Volume 2, EPA-450/3-81-0056, September 1982, OAQPS, U.S. EPA, RTP, NC 27711.

4. "BACT/LAER Clearinghouse-A Compilation of Control Technology Determinations," CPDD, OAQPS, U.S. EPA, RTP, NC 27711, May 1982.

5. "Assessment of Coal Dust Emissions from Power Plants for PSD Permit Applications," G. McVehil and T. A. Umenhofer (Sargent and Lundy), presented at American Power Conference, April 27-29, 1981, Chicago, Illinois.

6. "Improved Emission Factors for Fugitive Dust from Western Surface Coal Mining Sources," K. Axtell, Jr. and C. Cowherd, Jr., EPA Contract No. 68-02-2924, U.S. EPA, Cincinnati, Ohio, July 1981.

7. "Iron and Steel Plant Open Source Fugitive Emission Evaluation," C. Cowherd, Jr., R. Bohn, and T. Cuscino, Jr., EPA-600/2-79-103, May 1979.

DOCUMENTS RELEVANT TO EMISSION FACTORS SUPPLIED BY DEPARTMENT OF WATER AND POWER

A. PEDCo Environmental, Inc., October 25, 1979, PSD Review Contract No. 68-01-4147, Task No. 95, PN 3470-3-5.

B. Stearns-Roger, April 24, 1980, PEDCo BACT Review for Intermountain Power Project (IPP), near Lynndyl, Utah, October 25, 1979.

C. Coal Mining Emission Factor Development and Modeling Study, TRC, Englewood, Colorado, 1981.